Conceptualization of Guideline II: Guideline Model Concepts

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Academic Expert Supplement Project - A collaboration between Stanford University and the VA Palo Alto

Available from previous sessions

- Understanding of the content and the context for implementation of decision support
- A selection of (disambiguated) guideline concepts and statements to be encoded and applied to individual patient circumstances

Goals of this session

- Learn the purpose and structure of EON models

- Reformulate guideline statements in terms of EON models

Outline

- Define the EON models
- Activity: Define ATP III Workshop consensus within EON model

Purpose of EON models

- Create machine-interpretable version of clinical practice guideline to support patient-specific decision-support

- Generalizable - applied to different clinical practice guidelines and health care settings

- Self contained - no support for external knowledge bases

EON Models

- Models to create computer-interpretable guidelines:
  - A model of patient data
  - A model of medical concepts
  - A model of guideline statements

Structure: Patient data

- Clinical statements about patient
  - "John Doe has diabetes"
  - "John Doe's LDL cholesterol was 170mg/dl on 02/14/2006"
  - "John Doe is taking **lisinopril 20 mg/day** "
- Some high-level components:
  - Patient ID
  - Code
  - Value
  - Drug name
  - Drug dose
  - Time-stamp

Structure: Patient data in Database

Class Hierarchy

- :THING
  - :SYSTEM-CLASS
  - EPR_Entity
    - Encounter
    - Patient
    - Observation
      - Numeric_Entry
      - Note_Entry
      - Adverse_Reaction
    - Intervention
      - Procedures
      - Medication
    - Condition

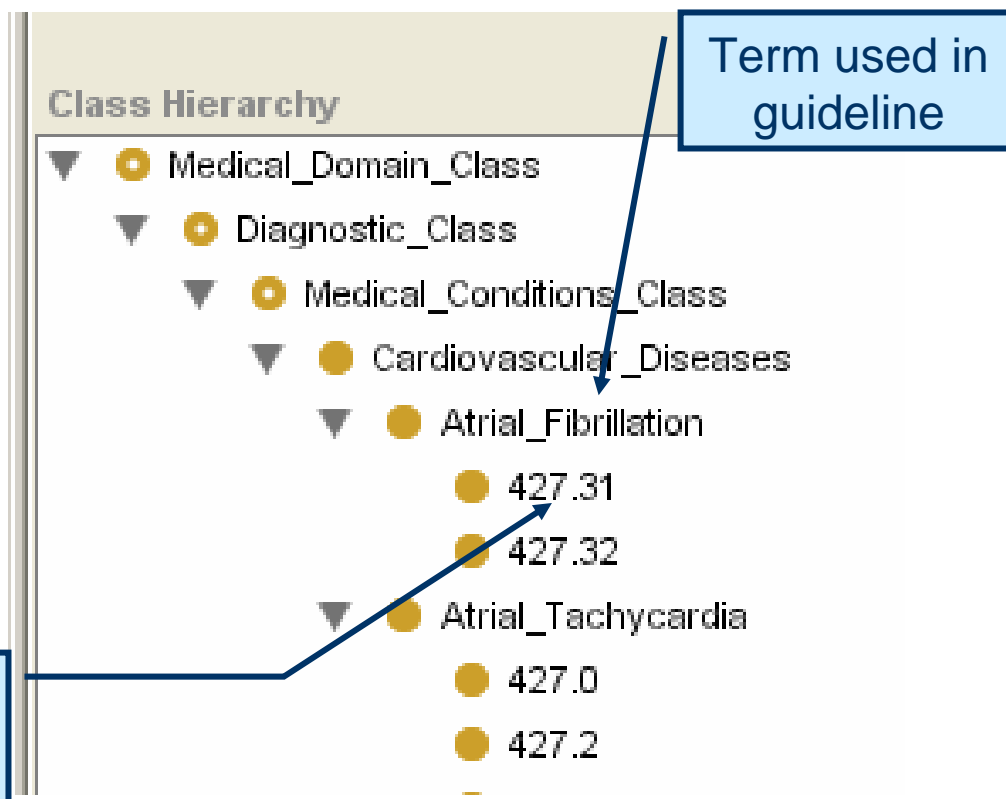|	Numeric entry	Note entry
Patient ID	John Doe	John Doe
Code (Domain term)	LDL (LOINC 4253)	Diabetes (ICD9 250.0)
Value	170	blank
Time-stamp	02/14/2006 2PM	05/05/2001 3PM

EON Models

- A model of patient data
- A model of medical concepts
- A model of guideline statements

Structure: Medical concepts (I)

- Concepts organized into classification hierarchies
- Defined by mapping codes in data

Term used in guideline

Class Hierarchy

- ▼ ◉ Medical_Domain_Class
  - ▼ ◉ Diagnostic_Class
    - ▼ ◉ Medical_Conditions_Class
      - ▼ ● Cardiovascular_Diseases
        - ▼ ● Atrial_Fibrillation
          - ● 427.31
          - ● 427.32
        - ▼ ● Atrial_Tachycardia
          - ● 427.0
          - ● 427.2

Code used in patient data

Structure: Medical concepts (II)

- Abstracted concepts
  - High Risk Category = (presence of CHD or CHD equivalent)
  - Low Risk Category= (count of risk factors<=1)

EON Models

- A model of patient data
- A model of medical concepts
- A model of guideline statements

Structure: Guideline Model

- Eligibility criteria
- Goals
- Patient characterization
- Properties of therapeutic options
  - indications and contraindications of drugs
  - Dose ranges of drugs
- Recommendations: clinical algorithm
  - What management alternatives should be recommended?
  - What messages should be displayed?

Examples from ATHENA HTN (I)

- eligibility
- goals
- abstractions about patient
- properties of treatment options

JNC-VI Hypertension Guideline (instance of ATHENA_Management_Guideline, int...

Label
JNC-VI Hypertension Guideline

Title

Version
June, 2001

Clinical Algorithm
- hypertension management diagram

Authors
NIH NHLBI Joint National Committee
Mary Goldstein, MD
Brian Hoffman, MD
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Eligibility Criteria
- presence of diagnosis of hypertension
- absence of renovascular disease
- no diagnosis of pregnancy
- creatinine < 2.5
- Absense of Secondary Hypertension
- absence of spinal cord injury
- absence of narcolepsy
- Not taking evelenerine

Goal
- BP target patient with DM, CHF or CRI
- BP target for patient without DM, CHF, and CRI

Patient Characterization
- Risk Group A (no risk factor and no TOD/CCD
- Risk Group B (presence of non-DM risk facto
- Risk Group C (presence of TOD/CCD or DM)
- hypokalemia in the past

Drug Classes
- Cardioselective Beta Blocker
- Non-cardioselective Beta Blocker
- ACE Inhibitor
- Metoprolol and terazosin

Guideline Drugs
- acebutolol
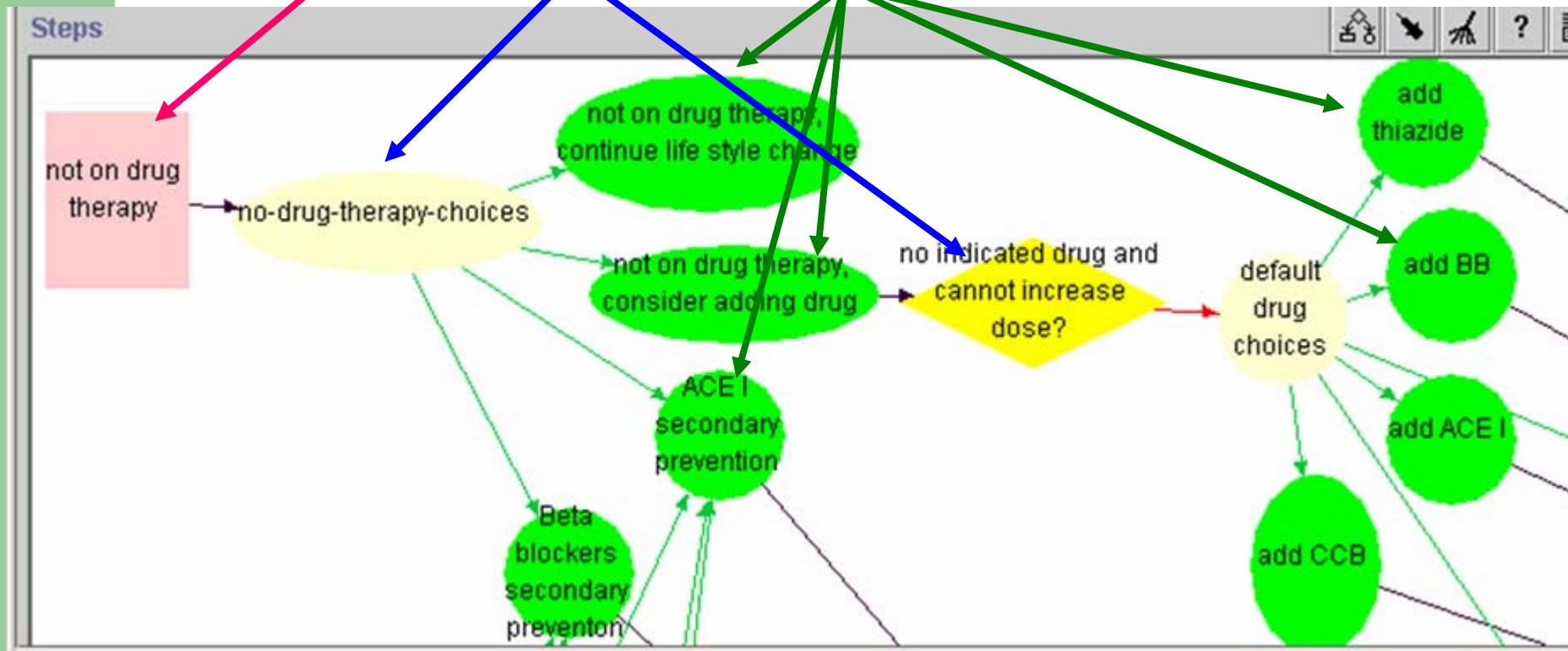- amiloride
- amlodipine
- amlodipine besylate

Clinical Algorithm

- Purpose: Generate recommendations
  - Messages
  - Drugs
  - Referral…

- Components:
  - Scenarios (starting point)
  - Decision nodes
  - Actions (recommendations)

ATHENA HTN (II): Clinical Algorithm

- **scenario**, **decisions**, **action choices**

Workshop activity

- Re-organize and reformulate ATP III guideline statements from previous session in terms of EON models

- Use Workshop Consensus

- We'll use the "see one, do one" model

Recap

Clinical Concepts

- Target Population
- Screening
- Risk factors
- Risk categories
- Guideline goals
- Threshold for initiating drug therapy
- Clinical algorithm

EON Guideline Model

- Documentation: title, authors, version
- Eligibility criteria
- Goal
- Patient characterization
- Clinical Algorithm
- Drug Usage
- Guideline drugs

Eligibility criteria

- **Purpose:** Define patients eligible for guideline recommendations
- **Directions:** Define the eligibility criteria in a formal statement
- **HINTS:**
  - Is it restricted by gender, age, race?
  - Are there any other conditions that would make patients ineligible?
  - Equivalent to target population?
- **Example**: (absence of transplant AND creatinine <2.5 AND presence of hypertension)

Your turn!

- Define Eligibility criteria in a formal statement

Eligibility criteria

Age>=20 AND
(sex=female AND absence of pregnancy)

Patient Characterization

- **Directions:** Characterize patients in terms of their risk category

- **Purpose:** Patient characterization is used to define patient groups of interest for the guideline.

- **Example**: Medium risk category = (count of risk factors>=2 AND (absence of CHD AND CHD equivalent)

Your turn!

- Define Low Risk and High Risk in a formal statement

Patient Characterization

- High Risk = (presence of CHD **OR** presence of CHD equivalent)

- Low Risk= (count of risk factors <=1 **AND** (absence of CHD **AND** CHD equivalent)

Goals

- **Purpose:** Define if patient met the guideline goal
- **Directions:** Define overall guideline goals per risk category in a formal statement.
- **Example: IF** medium risk category **THEN** LDL <130mg/dL

Your turn!

- Define Goals for High Risk and Low Risk in a formal statement

Goals

- **IF** High Risk **THEN** LDL<100mg/dL

- **IF** Low Risk **THEN** LDL<160mg/dL

Clinical Algorithm

- **Purpose:** Sketch a clinical algorithm with decision points patient data goes through to generate recommendations.
- **Directions:** Define starting point (patient scenario) and recommendations to be generated, and decision points between these.
- **Example**:
    - Patient scenario: Low Risk Category on no lipid lowering drug
    - Recommendations:
        - Order lipid profile
        - Maintain therapeutic lifestyle changes
        - LDL not at goal, start therapeutic lifestyle changes
        - LDL not at goal, start lipid lowering therapy

Clinical algorithm example

IF patient low risk **AND** absence lipid lowering therapy

No lipid profile → Order Lipid Profile

? → Maintain therapeutic lifestyle changes

160 **<=** LDL **<** 190 → LDL not at goal, start therapeutic lifestyle changes

? → LDL not at goal, start lipid lowering therapy
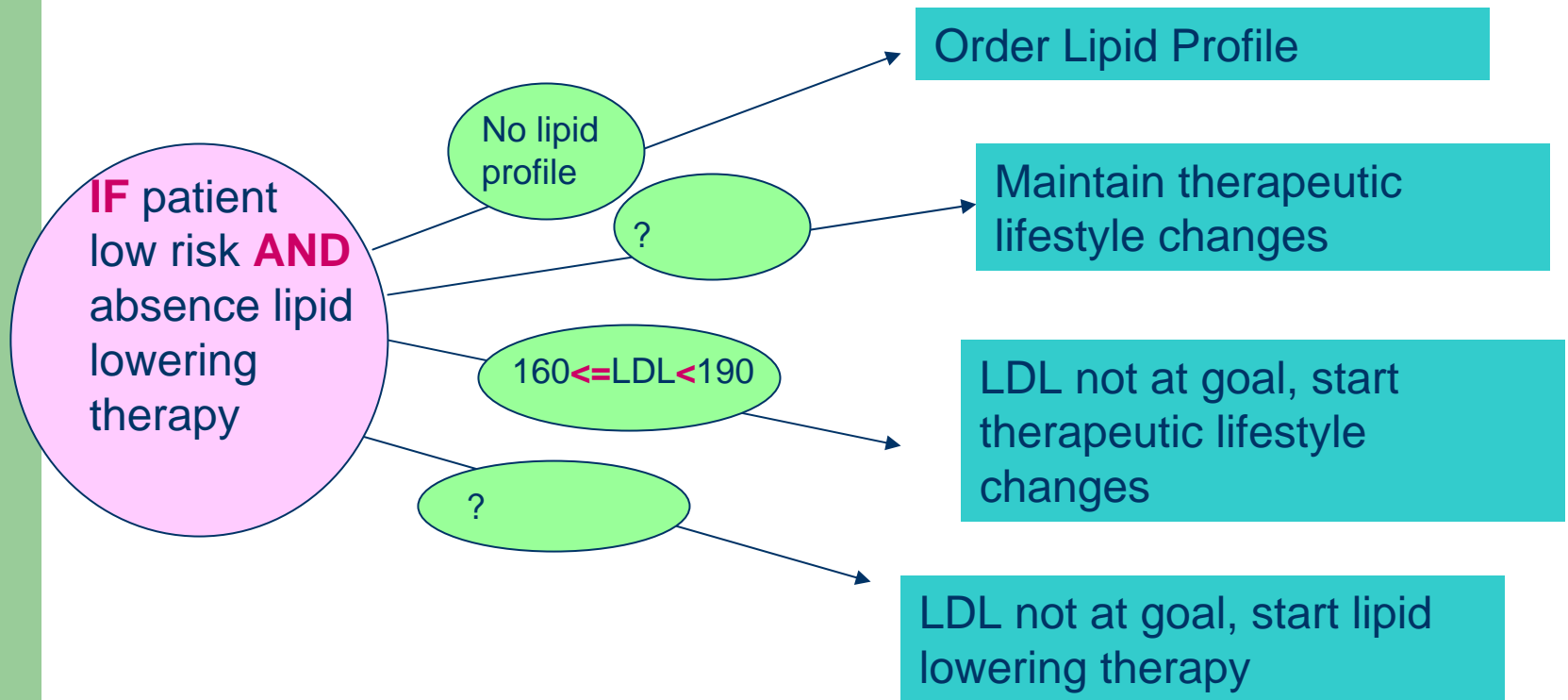
Your turn!

- **Patient scenario: High Risk with prescription for simvastatin**

- **Recommendations to generate:**
  - **"Order lipid profile"**
  - **"Patient meets LDL goal, continue therapeutic lifestyle changes"**
  - **"Patient not at LDL goal, increase dose of simvastatin"**
  - **"Patient not at LDL goal, add nicotinic acid"**

Clinical algorithm: CHD or CHD equivalent

IF patient CHD or CHD equivalent risk **AND** active prescription for simvastatin

No lipid profile → Order Lipid Profile

LDL <100 → Maintain therapeutic lifestyle changes

LDL >=100

Statin at Max dose? → **NO** → Increase dose of simvastatin

LDL >=100 → Add nicotinic acid
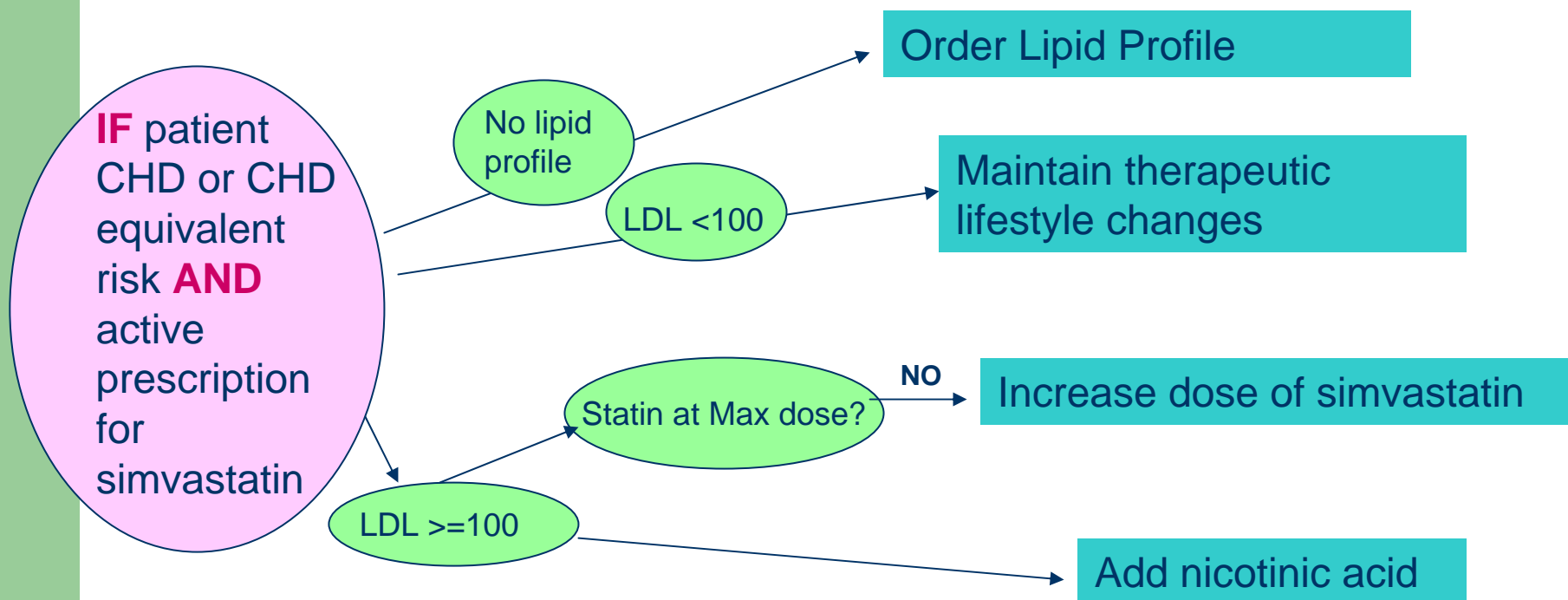
Drug Usage: Addition Behavior

- Strong contraindication
- Drug Partner to avoid

Recommend Drug

- Compelling indication
- Relative indication
- Relative contraindication

Recommend Drug

- Preferred drug: specific drug to add (formulary)

Recommend Simvastatin

ATHENA-Hypertension

Compelling Indication 🗸	Relative Indication ○	Strong Contraindication ✖	Relative Contraindication ⚠	Adverse Events ⊘

Consider one of the following therapeutic possibilities	Click here for important	Reasons		Click here to provide ....
Increase dosage of hydrochlorothiazide	Info			Feedback
Add Cardioselective Beta Blocker (atenolol)	Info	🗸 **Hypertension**		Feedback
		○ **Atrial Tachycardia**		
		⚠ **Depression**		

Drug Usage

- **Purpose:** the program examines properties supporting or blocking a drug recommendation to generate a recommendation

- **Directions:** Define properties as formal statements in drug class

- **Example**: Nicotinic Acid (2nd choice)

Drug Usage: Nicotinic Acid

- **Relative indication**:
  - LDL not at goal
- **Absolute contraindication**:
  - Presence of chronic liver disease (ICD9 codes)
  - Presence of gout with tophi (ICD9 codes)
  - Presence of adverse drug reaction/allergy
- **Relative contraindication**:
  - Presence of diabetes (ICD9 OR Use insulin)
  - Presence of peptic ulcer disease (ICD9)
  - Uric acid>=6.8
- **Preferred drug**: Sustained Release Nicotinic Acid

Your turn!

- **Define using formal statements properties for the drug class Statins (1st choice)**
- ➢ **Compelling indication**
- ➢ **Absolute contraindication**
- ➢ **Relative contraindication**
- ➢ **Preferred drug**

Drug Usage: Statins

- **Compelling indication**:
  - LDL not at goal
- **Absolute contraindication**:
  - Presence of liver disease (ICD9 codes OR (AST>=40 or ALT>=40))
  - Presence of adverse drug reaction/allergy
- **Relative contraindication**:
  - Presence of active prescription for erythromycin
  - Presence of active prescription for cyclosporine
- **Preferred drug**: lovastatin

Guideline drug

- **Purpose:** define drug properties such as dose ranges to evaluate increasing dose

- **Directions:** Define dose ranges for specific drugs. If drug dose is in high dose range, system will not recommend dose increase

- **Example:** Sustained Release Nicotinic Acid
  – Low dose range: 1-1.5g
  – High dose range: 1.6-2g

Your turn!

- **Drug class: Statins**

➢ **Dose ranges for Lovastatin**

➢ **Dose ranges for Simvastatin**

Guideline drug

- Lovastatin:
  - Low dose range:20-30mg
  - High dose range:31-40mg
- Simvastatin
  - Low dose range:40-60mg
  - High dose range:61-80mg

Summary

- Eligibility criteria
- Goals
- Patient characterization
- Clinical algorithm
- Drug Usage
- Guideline drugs